

# **Portsmouth-Eliot SO<sub>2</sub> Background Information**

Provided by New Hampshire Department of Environmental Services



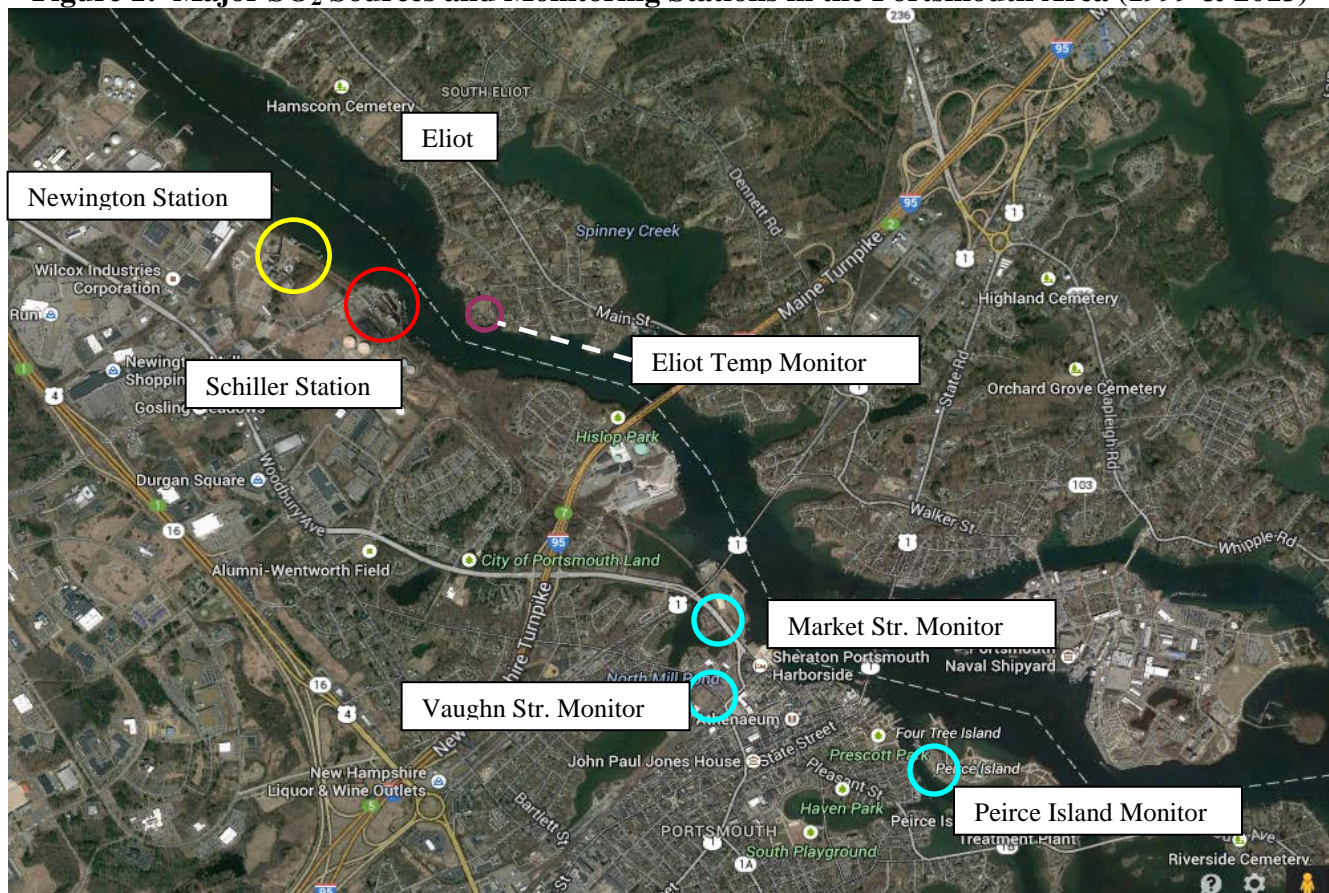
March 4, 2014

## Introduction

This document provides information regarding available monitoring and modeling of 1-hour sulfur dioxide (SO<sub>2</sub>) impacts from Schiller Station in Eliot, Maine over recent years. Eliot and nearby areas in New Hampshire are currently designated as unclassifiable for the 2010 1-hour SO<sub>2</sub> national ambient air quality standard (NAAQS) until the next phase of the standard's implementation is published and methodology is established for final designation. Recent SO<sub>2</sub> measurements from the Peirce Island monitor do not suggest that the Portsmouth area should be designated as nonattainment, however official modeling for major SO<sub>2</sub> sources in the area has not yet been conducted. As of January of 2014, only areas with monitored design values in excess of the 1-hour SO<sub>2</sub> NAAQS were required by EPA to be designated as nonattainment.

On August 22, 2013, the Town of Eliot Maine filed a section 126 petition against Schiller station for causing violations of the 2010 1-hour SO<sub>2</sub> NAAQS within their borders. A variety of modeling scenarios were provided in the petition (conducted by a consultant, Wingra Engineering, on behalf of Sierra Club), however based on EPA's technical assistance documentation, NHDES considers only modeling of recent actual power plant emission scenarios to be appropriate for assessing recent actual air quality conditions in Eliot with regard to the section 126 petition. Many of the modeling results provided in the petition are either theoretical, based on maximum allowable power plant emissions (not replicated actual), or they are older operations occurring prior to the promulgation of the 1-hour SO<sub>2</sub> NAAQS cited in the petition. Further, none of the tabulated modeled SO<sub>2</sub> impacts provided in the petition are for locations within Eliot itself. As a result, NHDES decided to replicate the modeling analysis included in the section 126 petition using Sierra Club files, so that recent modeled concentrations in Eliot could be assessed. This information and all available monitoring data for the area are summarized below. An overview of the study area is shown in Figure 1.

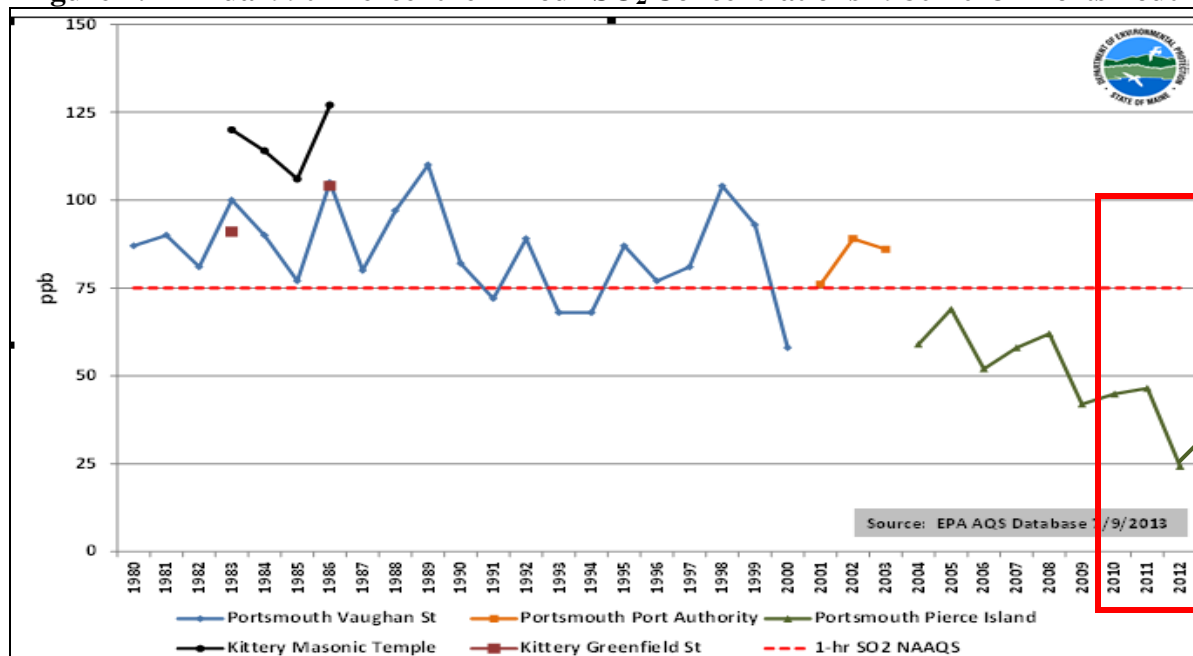
**Figure 1: Major SO<sub>2</sub> Sources and Monitoring Stations in the Portsmouth Area (1999 & 2013)**



## SO<sub>2</sub> Monitoring

SO<sub>2</sub> monitoring in the Portsmouth Area has been conducted for over 30 years in a variety of locations in New Hampshire and Maine. The 99th percentile 1-hour SO<sub>2</sub> data along with the 2010 1-hour SO<sub>2</sub> NAAQS are summarized below in Figure 2. Since the SO<sub>2</sub> NAAQS was promulgated in 2010, no monitored violations have occurred (please see the red box on the right side of the figure).

**Figure 2: Annual 99th Percentile 1-Hour SO<sub>2</sub> Concentrations 1980-2013 - Portsmouth Area**



Source of graphic: Maine DEP. Value for 2013 subsequently added.

Table 1 tabulates the most recent eight years of 1-hour SO<sub>2</sub> monitoring in the Portsmouth area. The last time the 75ppb standard was exceeded was in 2008 (although the 2010 1-hr SO<sub>2</sub> standard was not in place at that time)<sup>1</sup>. For each year, Table 1 shows the overall maximum 1-hr SO<sub>2</sub> value (2nd column), the maximum of the daily 99th percentile 1-hour values (3rd column), the 99th percentile over all hours (4th column), the average of the daily maximum 1-hour values (5th column), and the average of the 1-hour values over all hours (6th column).

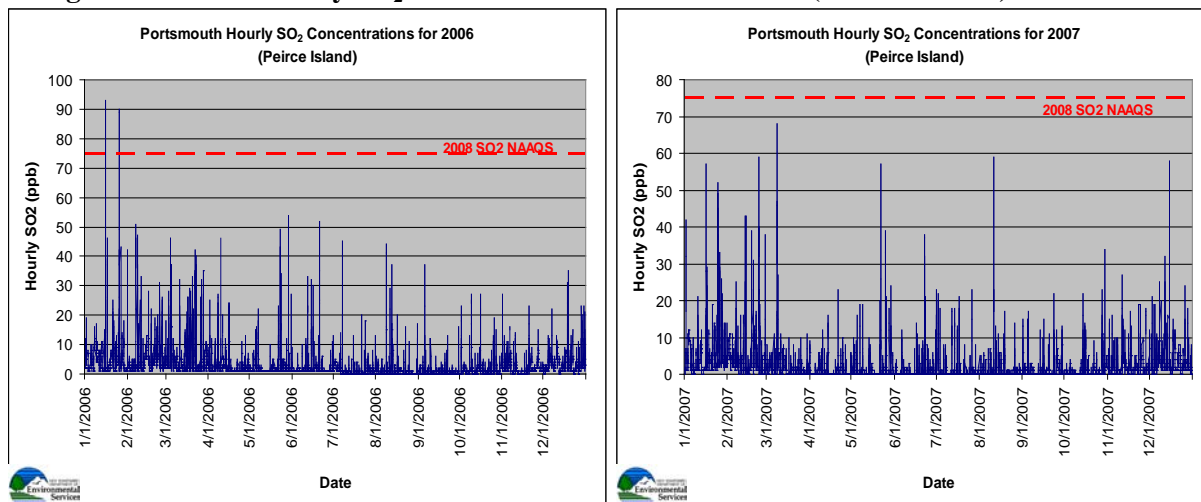
**TABLE 1: Portsmouth Peirce Island 1-Hour SO<sub>2</sub> Monitoring Data, in ppb (2006-13)**

Year	Max	99th % (daily)	99th % (All Hours)	Average Daily Max	Average All Hours
2006	93	52	26	11.0	3.1
2007	68	58	20	9.3	2.2
2008	85	62	19	9.2	2.4
2009	73	42	20	8.0	2.2
2010	48	45	20	8.7	2.3
2011	70	37	15	5.5	1.3
2012	34	21	8.0	2.7	0.6
2013	33	31	9.5	3.1	0.7

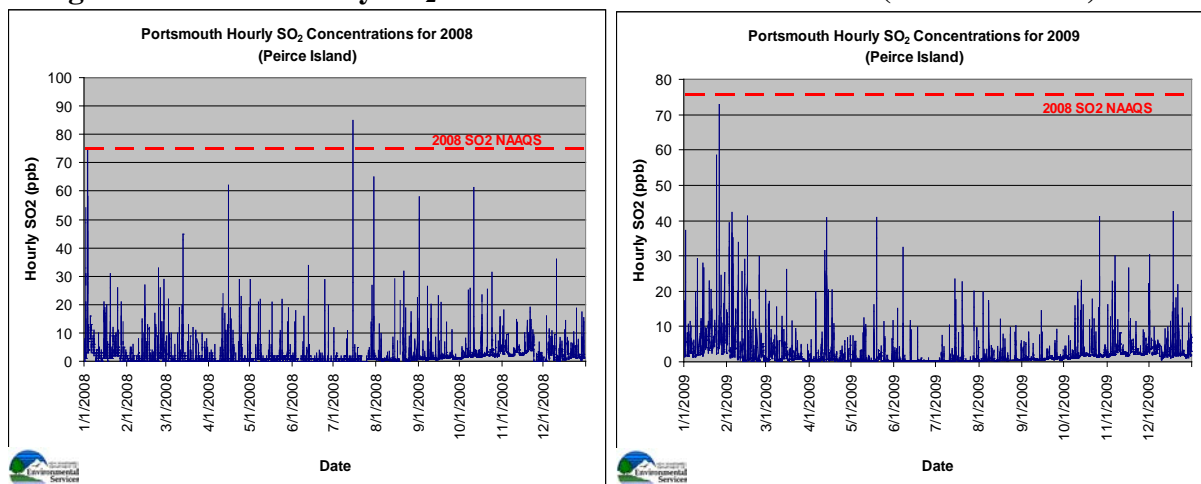
<sup>1</sup> Please note that a single 1-hr value above the level of the standard does not necessarily constitute a violation of the NAAQS. In order for the 1-hour SO<sub>2</sub> NAAQS to be exceeded, the 3-yr average of the 99th percentile of 1-hour daily maximum values must exceed 75 ppb.

Figures 3-10 show annual 1-hour SO<sub>2</sub> monitored timelines from 2006-2013.

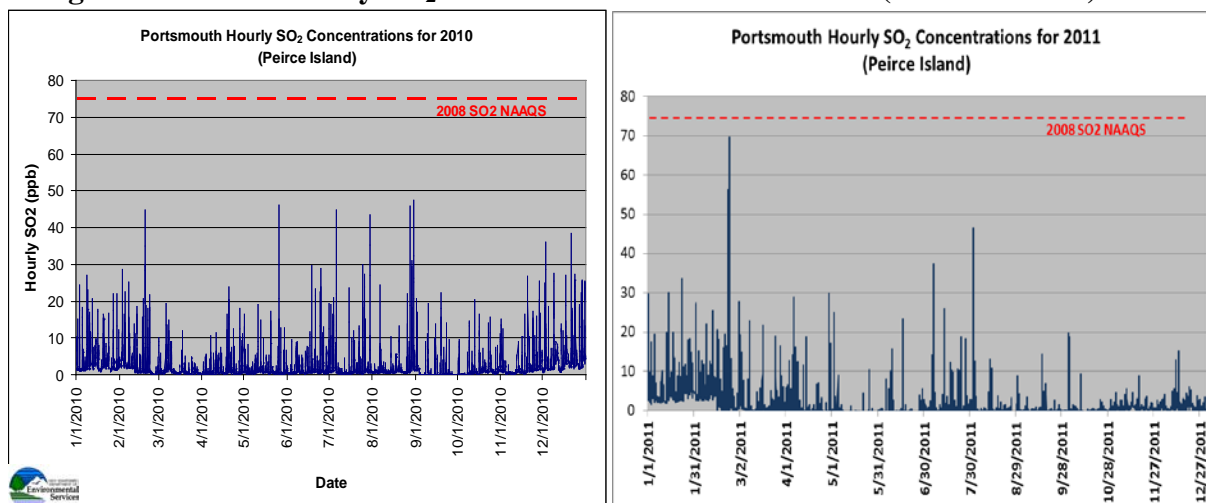
**Figures 3 and 4: Hourly SO<sub>2</sub> Concentrations for Portsmouth (2006 and 2007)**



**Figures 5 and 6: Hourly SO<sub>2</sub> Concentrations for Portsmouth (2008 and 2009)**



**Figures 7 and 8: Hourly SO<sub>2</sub> Concentrations for Portsmouth (2010 and 2011)**



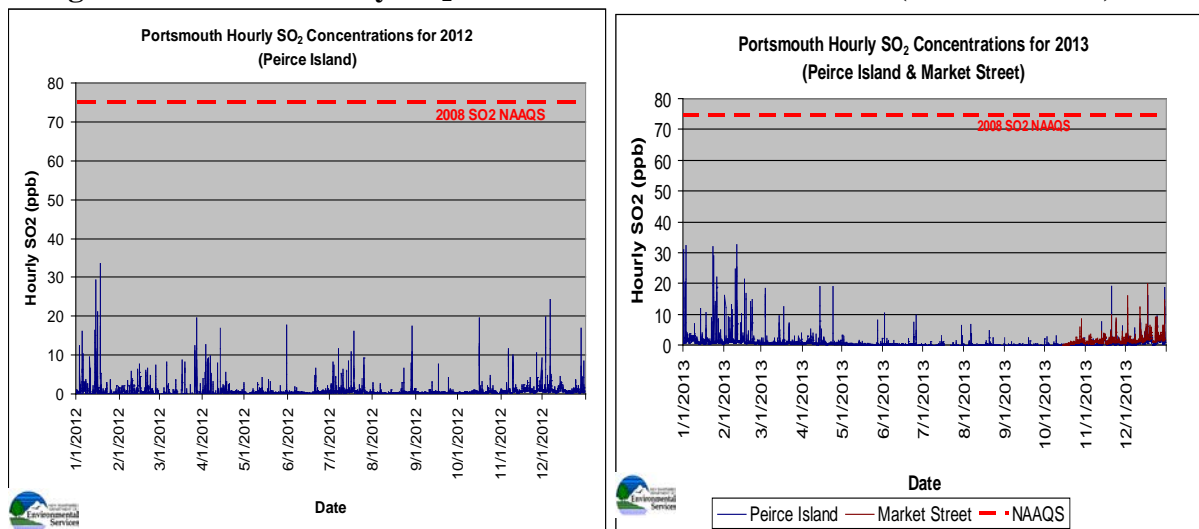
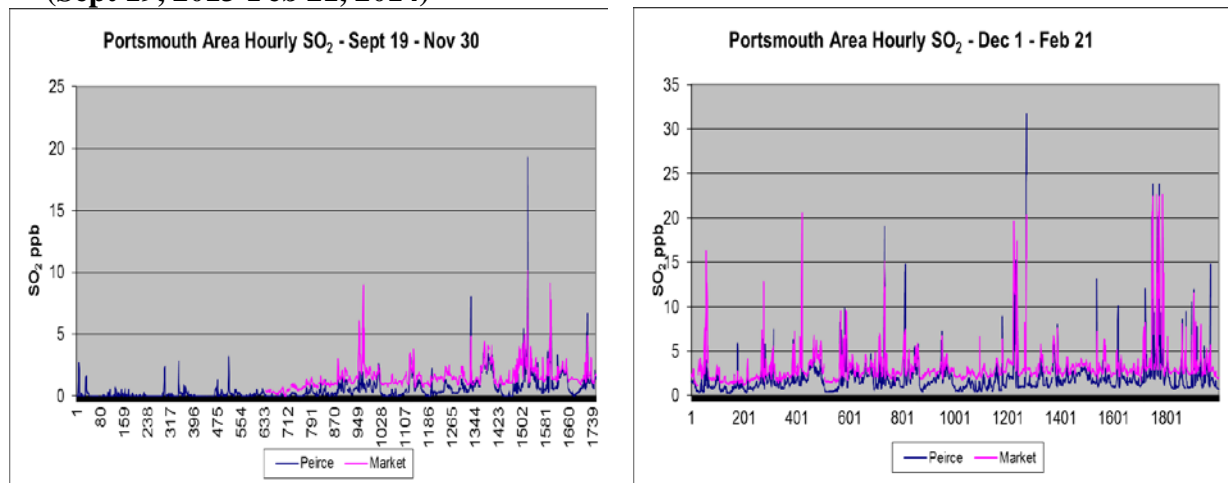
**Figures 9 and 10: Hourly SO<sub>2</sub> Concentrations for Portsmouth (2012 and 2013)**

Table 2 presents some new monitoring in the Portsmouth area at a location closer to Schiller Station (Market Street – see Figure 1). This data is not official, however it is pertinent.

**TABLE 2: Portsmouth 1-Hour SO<sub>2</sub> Monitoring Comparison, in ppb (October 2013- February 2014)**

Year	Max	Average Daily Max	Average All Hours
Peirce Island	32	3.9	1.4
Market Street	23	5.1	2.6

Figures 11 and 12 show comparative hourly monitoring data for Peirce Island and Market Street for the period of September 19, 2013 through February 21, 2014. The Market Street location shows slightly higher SO<sub>2</sub> concentrations on average, but Peirce Island had some higher peaks than corresponding periods at Market Street. During this period, while Schiller Station's three coal units were in operation, the monitored 1-hour SO<sub>2</sub> concentrations have not exceeded 37ppb (one-half of the SO<sub>2</sub> NAAQS).

**Figures 11 and 12: Hourly SO<sub>2</sub> Concentration Comparisons for Portsmouth (Sept 19, 2013-Feb 21, 2014)**



There are other SO<sub>2</sub> sources in the Portsmouth area, especially ship traffic along the river. It is not unusual for the Peirce Island to measure increases in SO<sub>2</sub> that don't correlate well with the local power plants and are likely the result of passing ships or ships idling at nearby docks. The Market Street monitor is located directly across the street from the location pictured in Figure 13.

**Figure 13: Ship docked along Piscataqua River for loading – February 2014**



### 1999 Eliot Monitored SO<sub>2</sub> Data

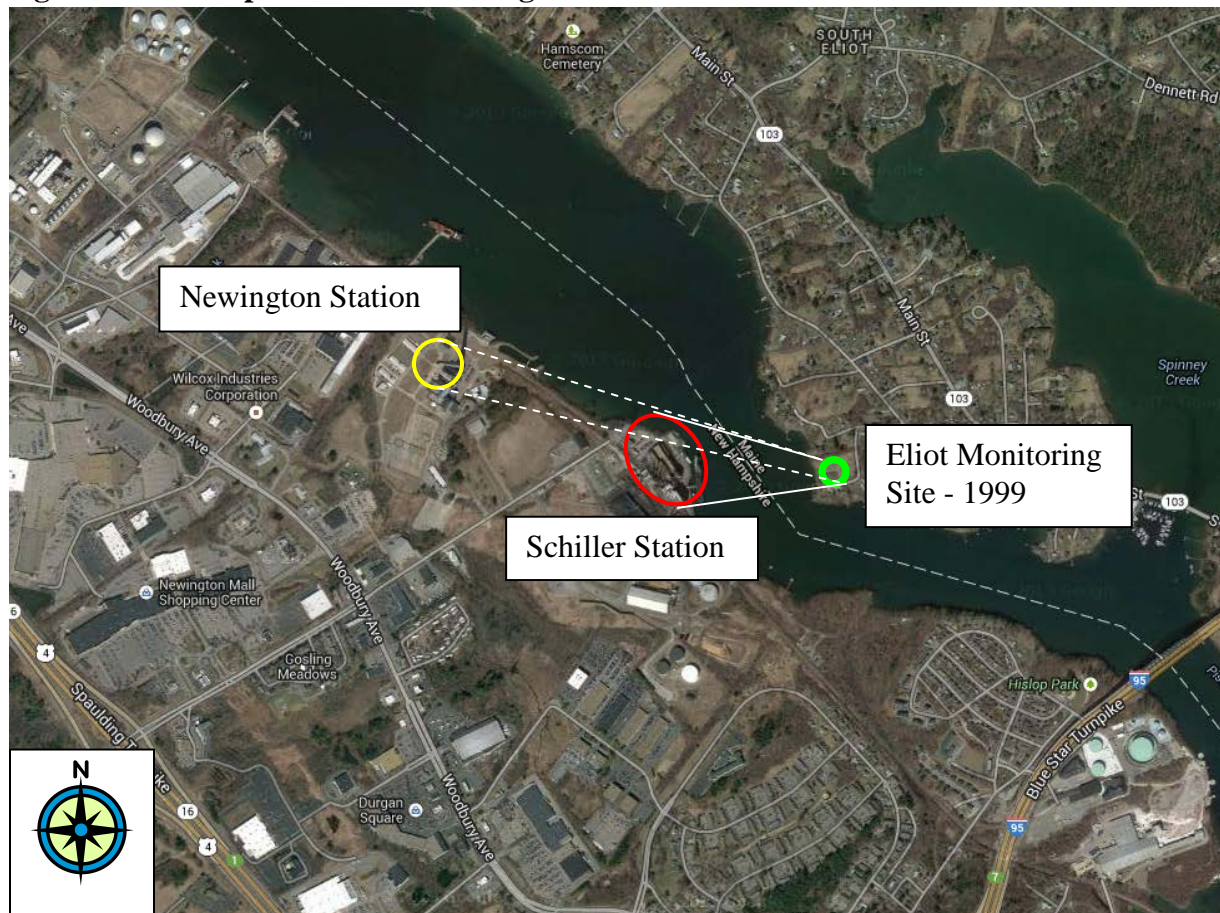
NHDES conducted hourly SO<sub>2</sub> monitoring in Eliot Maine for a 30-day period in August and September of 1999. The monitor was located about 800 yards to the east of Schiller Station (please see Figure 14). A temporary monitoring station was set up during this period to track total suspended particles (TSP) deposition in the area. Monitoring for SO<sub>2</sub> was conducted to act as a tracer for power plant combustion. The location of this monitor was identified in modeling documented below as a location of maximum power plant impact (see receptor #3 in Figure 20). One-hour SO<sub>2</sub> impacts from this monitoring are documented in Table 3.

**Table 3: Summary of Available 1-Hour SO<sub>2</sub> Monitoring Data for Eliot, Maine -1999 (ppb)**

Maximum	Maximum with Confirmed Schiller Station Contribution*	Average Daily Maximum	Average of All Available Hours
128	51	15.5	2.9

\* - Maximum SO<sub>2</sub> concentration with a wind coming from a 90 degree sector centered on Schiller Station

**Figure 14: Map of Eliot Monitoring Site**



Eliot monitoring site is denoted by green circle, Schiller Station is marked by a red circle, and Newington station is marked by a yellow circle. Impacts at the Eliot monitor due to Schiller Station would be most likely to occur with wind directions from the west (230 to 320 degrees from north).

During this time period in 1999, Schiller Station operated more frequently than seen in recent years. Further, in 1999 Unit #5 operated as a coal utility boiler prior to its conversion to biomass in 2006. Thus, during this study, Schiller Station operated as a three coal utility boiler power plant at loads generally ranging from 1.0 to 1.7 lb SO<sub>2</sub>/mmBTU. Today it operates two coal utility boilers and one biomass unit, of which only the biomass unit is operated frequently.

Also in 1999, nearby Newington Station operated frequently burning a 2% sulfur #6 fuel oil (approximately 2.016 lb SO<sub>2</sub>/mmBTU). Today it operates essentially as a peaking unit with Best Available Retrofit Technology (BART) control operations limiting it to 0.50lb SO<sub>2</sub>/mmBTU. Because of the economics of fuels, Newington Station now usually operates with natural gas, but it does have a reserve of low sulfur fuel oil to meet electrical demand if called upon.

The table below has been extracted from the October 4, 2013 review report of the 1999 Eliot data. Reported daily 1-hour maximum SO<sub>2</sub> concentrations are provided for each day Eliot, Maine data was available. Data listed as Eliot shadow isolates SO<sub>2</sub> concentrations (when winds came from the general direction of Schiller Station), allowing about 90 degrees so that swirling winds can be considered. Portsmouth data was collected at the Vaughn Street NHDES monitoring station (See Figure 15).

The highest hourly SO<sub>2</sub> concentration was 128 ppb measured on August 23, 1999. Winds at the time were measured to be coming from the south. Winds reported at nearby Pease Airport were also measured as coming from the south during this period. Portsmouth Vaughn Street station also measured a high hourly SO<sub>2</sub> value (115ppb) on that same day. Winds at the time were recorded as coming from the east. The maximum measured SO<sub>2</sub> concentration in Eliot when the winds were confirmed to be coming from the direction of the power plant was 51ppb on September 17, 1999. See Figure 14 for a diagram of the area.

**Table 4: 1999 Eliot Monitoring Data, Summary of All Daily Maximum 1-Hour SO<sub>2</sub> Concentrations**

Date	Eliot SO <sub>2</sub> (ppb)	Wind Speed at Max	Wind Direction at Max	Eliot SO <sub>2</sub> (ppb) Shadow	Wind Speed at Max	Wind Direction at Max	Portsmouth SO <sub>2</sub> (ppb)	Wind Speed at Max	Wind Direction at Max
8/22	2	3	200	0	1	250	7	1	278
8/23	128	8	180	5	3	290	115	3	9
8/24	8	2	175	4	2	280	7	2	53
8/25	36	6	115	3	1	270	14	2	78
8/26	10	4	175	2	0	250	6	4	143
8/27	2	2	85	0	None	None	0	None	None
8/28	40	6	260	40	6	260	4	5	261
8/29	43	3	275	43	3	275	14	8	345
8/30	3	3	320	2	10	310	12	5	331
8/31	6	5	140	1	1	240	1	5	107
9/1	4	6	135	2	2	280	8	2	51
9/2	9	5	180	6	2	270	9	1	116
9/3	16	7	140	3	6	310	11	6	140
9/4	9	5	130	0	None	None	5	2	127
9/5	2	1	150	0	None	None	0	None	None
9/6	2	5	195	0	None	None	2	4	104
9/7	1	3	165	0	None	None	0	None	None
9/8	5	5	195	0	None	None	3	5	194
9/9	9	9	185	1	9	270	5	9	183
9/10	3	4	135	0	None	None	3	3	350
9/11	38	9	305	38	9	305	11	6	325
9/12	11	6	40	3	1	270	77	4	15
9/13	6	6	130	0	0	270	1	0	100
9/14	4	6	335	1	1	270	3	2	8
9/15	5	1	170	1	1	245	2	3	180
9/16	1	8	55	0	None	None	1	9	55
9/17	51	8	310	51	8	310	6	5	306
9/18	3	N/A	N/A	0	N/A	N/A	N/A	N/A	N/A
9/19	3	N/A	250	3	N/A	250	N/A	N/A	N/A
9/20	5	1	325	2	1	295	5	5	211

Note: "None" indicates the wind never came from the shadow of the power plant during the date and N/A indicates no data was available. Maximum 1-hour SO<sub>2</sub> concentrations for the sampling period are highlighted in green.



**Figure 15: Map of Eliot Monitoring area**

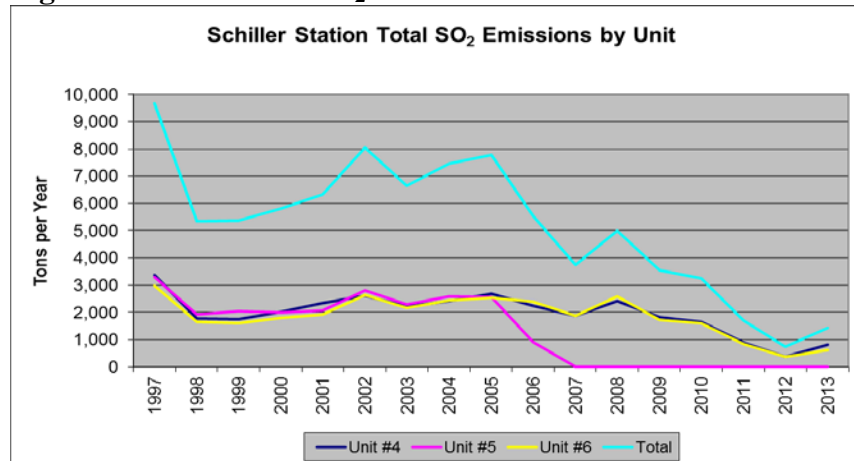
Eliot monitoring site is denoted by green circle, Schiller Station is marked by a red circle, the yellow circle indicates the location of the NHDES Vaughn Street monitor, and the blue circle shows the location where wind information is collected at Pease International Airport. Pease wind information is used to validate data collected at Vaughn Street. Note: the Pease wind information was collected at a height of 4 meters instead of the usual 10 meters.

The full Eliot review is provided in Attachment A and the full original Eliot monitoring report is in Attachment B.

## Schiller Station Emissions

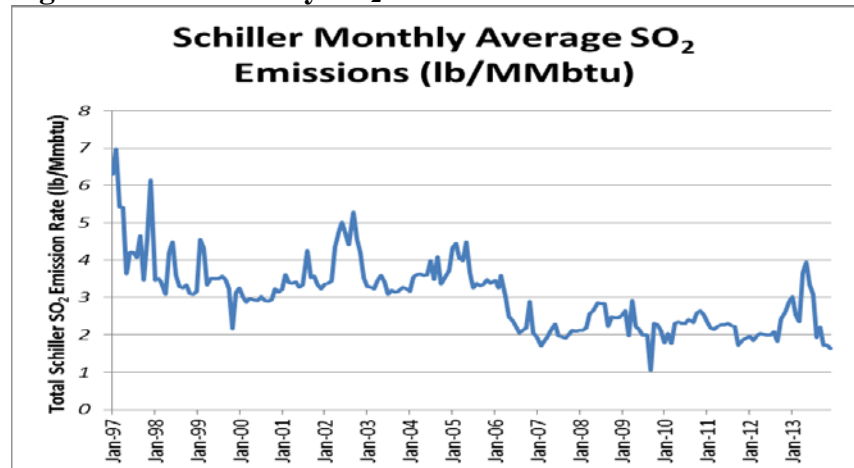
Historical SO<sub>2</sub> emissions, monthly and annual average emission rates, and hours of operation are shown in Figures 16 through 19 for Schiller station. Notes accompany each figure. It is important to note that Schiller Unit #5 was converted from coal to biomass in 2006.

**Figure 16: Annual SO<sub>2</sub> Emissions - Schiller Station**



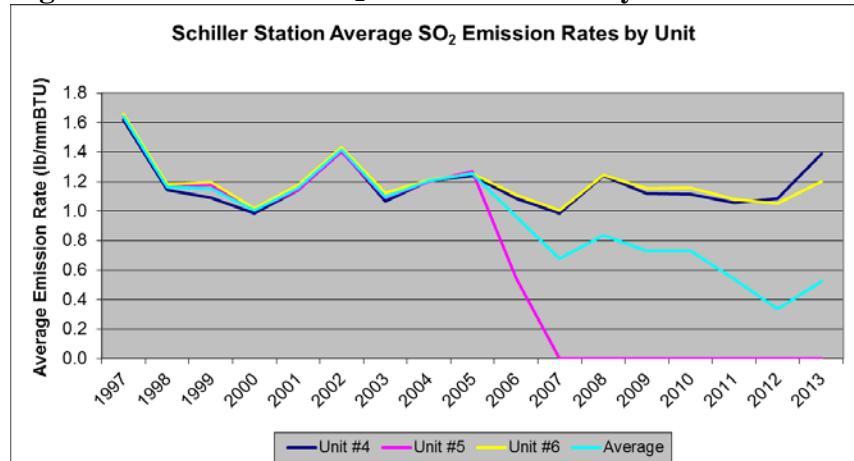
Annual SO<sub>2</sub> emissions at Schiller Station are down almost 90% from 1997 due to a shift to lower sulfur coal and a conversion of one boiler from coal to biomass in 2006. Even with the recent uptick in plant utilization in 2013, overall emissions are down significantly.

**Figure 17: Monthly SO<sub>2</sub> Emissions Rates for Schiller Station**

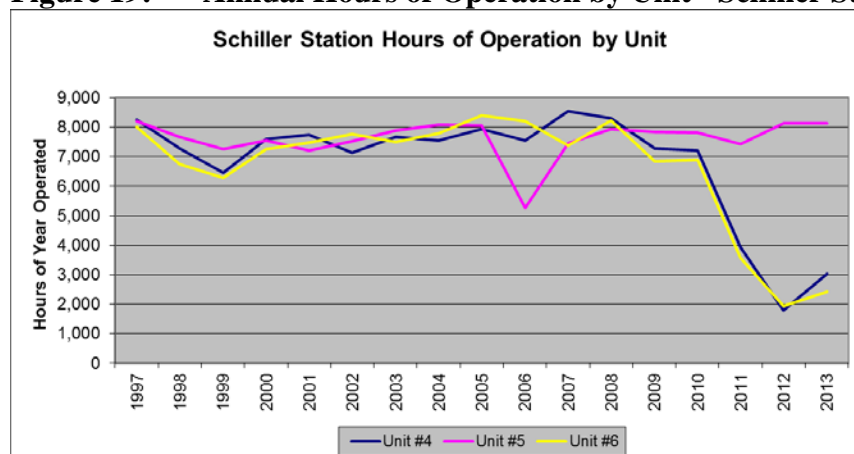


Average monthly SO<sub>2</sub> emission rates in pounds per million BTU are also down due to the same factors. There is a cyclical rate where peak emissions are most likely to occur during winter and summer. Note the one-third SO<sub>2</sub> emission rate decrease in 2006 when unit #5 was converted to biomass use.

**Figure 18: Annual SO<sub>2</sub> Emissions Rates by Unit - Schiller Station**



Annual average SO<sub>2</sub> emission rates in pounds per million BTU show the same pattern of decrease. Note that in 2006 unit #5's SO<sub>2</sub> emission rates drop to near zero due to the conversion to biomass.

**Figure 19: Annual Hours of Operation by Unit - Schiller Station**

Annual hour of operation by boiler show significant drops in utilization starting in 2011 for the coal units #4 and #6. Meanwhile, the biomass unit #5 maintains a high rate of utilization.

## Relevant Modeling

There are a limited number of modeling analyses that have been conducted for Schiller Station, most of which focused on permitting needs in the area. These analyses focused on the applicable NAAQS at the time of the modeling and are not readily usable for a 1-hour duration standard. Such permit modeling analyses generally focus on ensuring the NAAQS is never violated and thus assess maximum permitted or allowable emissions. While these analyses are useful, they may not reflect actual recent conditions upon which attainment designations are usually based. On the other hand, monitoring data reflects actual operations and weather conditions for the period. However, there are not enough SO<sub>2</sub> monitors located to evaluate all localized impacts that might exist, and therefore EPA has proposed to include modeling in the designation process. Unfortunately, since such techniques are relatively new in attainment designation application, EPA has not yet finished developing its official rules or guidance for applying modeling. It has provided a set of non-binding recommendations for source modeling that includes the use of actual recent emissions and meteorology to supplement monitoring (2013 EPA technical assistance documentation).

No official SO<sub>2</sub> designation modeling exists to date for Schiller Station that uses recent actual emissions and monitoring data. However, the Sierra Club, through its contractor Wingra, shared their modeling analyses for a variety of time periods using a range of emission scenarios (documented below). This modeling formed the basis for the Town of Eliot section 126 petition vs. Schiller Station.

As described above, for current 1-hour SO<sub>2</sub> attainment purposes, the most recent periods of actual operations are most relevant. This would include Sierra Club runs 6 (2010-12) and 9 (2010-13) listed below.

### Sierra Club Modeling provided in the Eliot Section 126 Petition

Runs of 5-years (2006-2010)

1. Allowable SO<sub>2</sub> emissions (2.9 lb/mmBTU) - constant
2. Allowable SO<sub>2</sub> emissions (2.4 lb/mmBTU) - constant
3. Actual (maximum 2010 hourly) (1.69 unit 4/ 2.24 unit 6 lb/mmBTU) - constant

Runs of 1-year (2006-2012) with results averaged in 3 year increments

4. Allowable SO<sub>2</sub> emissions (2.4 lb/mmBTU) - constant
5. Actual (maximum 2010 hourly) (1.69 unit 4/ 2.24 unit 6 lb/mmBTU) - constant
6. Actual hourly (continuous emissions monitoring system, or CEMS) - variable

Runs of 1-year increments (4/2010-3/2013) with results averaged for 3 year period

7. Allowable SO<sub>2</sub> emissions (2.4 lb/mmBTU) - constant
8. Actual (maximum 2010 hourly) (1.69 unit 4/ 2.24 unit 6 lb/mmBTU) - constant
9. Actual hourly (CEMS) - variable

Results for the Sierra Club modeling are summarized in Table 6. It should be noted that the impacts documented for the state of Maine were not modeling results for the Town of Eliot. NHDES had to replicate the Sierra Club modeling in order to identify power plant impacts for Eliot (See next page).

Results of Sierra Club Modeling:

**Table 6: Maximum Total Predicted 1-hr SO<sub>2</sub> Concentration (ppb)**

Run	Scenario (#s in parentheses are lb/mmBTU)	Locations in Maine*	Background (NH/ME)
1 (2006-10)	Allowable (2.9)	249 (5-yr avg)	50/4
2 (2006-10)	Allowable (2.4)	207 (5-yr avg)	50/4
3 (2006-10)	Max Actual (1.69/2.24)	170 (5-yr avg)	50/4
4 (2006-08)	Allowable (2.4)	285	Not specified
4 (2007-09)	Allowable (2.4)	315	Not specified
4 (2008-10)	Allowable (2.4)	294	Not specified
4 (2009-11)	Allowable (2.4)	304	Not specified
4 (2010-12)	Allowable (2.4)	292	Not specified
5 (2006-08)	Max Actual (1.69/2.24)	234	Not specified
5 (2007-09)	Max Actual (1.69/2.24)	258	Not specified
5 (2008-10)	Max Actual (1.69/2.24)	241	Not specified
5 (2009-11)	Max Actual (1.69/2.24)	249	Not specified
5 (2010-12)	Max Actual (1.69/2.24)	239	Not specified
6 (2006-08)	Actual Hourly	129	Not specified
6 (2007-09)	Actual Hourly	127	Not specified
6 (2008-10)	Actual Hourly	106	Not specified
6 (2009-11)	Actual Hourly	78	Not specified
6 (2010-12)	Actual Hourly	65	Not specified
7 (2010-13)	Allowable (2.4)	286	Not specified
8 (2010-13)	Max Actual (1.69/2.24)	234	Not specified
9 (2010-13)	Actual Hourly	74**	Not specified

\* - Maximum predicted 1-hour SO<sub>2</sub> concentrations in Maine did not occur in Eliot and the section 126 petition did not provide predicted 1-hour SO<sub>2</sub> concentrations for locations within Eliot.

\*\* - Value reproduced in NHDES modeling but is not located in Eliot, Maine.

Because Sierra Club did not identify Schiller Station impacts for Eliot in the modeling documentation, NHDES performed additional modeling with the Sierra Club files. Modeling results for Eliot locations were processed with Portsmouth background monitoring with the form of the 1-hour SO<sub>2</sub> standard data in a way consistent accepted modeling practices. Further detail is provided in the section below.

It should be noted that PSNH's contractor for modeling reviewed the modeling analysis included in the Eliot section 126 petition and identified a number of modeling details modeling that are in need of correction. However, at this time such corrections are not available to NHDES and the following modeling replication was performed with the Wingra files as provided.



## **NHDES Exploratory Modeling**

Results of DES Modeling (Completed with Sierra Club Modeling files)

A) Used the Wingra Engineering modeling files for the period of 4/2009 - 3/2013.

B) Used Google Earth to identify all Wingra modeled receptors located in Eliot, ME.

C) Used Wingra Engineering "ACTUAL" source emission files for modeling with a select group of receptors located throughout Eliot, ME. A total of 13 receptors were selectively included to represent locations identified by NHDES as having maximum power plant impacts in Eliot based on Wingra's modeling.

Additional receptors were added to geographically cover Eliot, and to represent the Pierce Island monitor and the Wingra receptor of maximum impact in Maine (not located in Eliot):

1) **Receptor 1** is the area of the overall maximum 1-hour concentration in Eliot (located about 1,200m NE of Schiller).

2) **Receptor 2** is an area of secondary maximum in Eliot located about 8,500m N of Schiller.

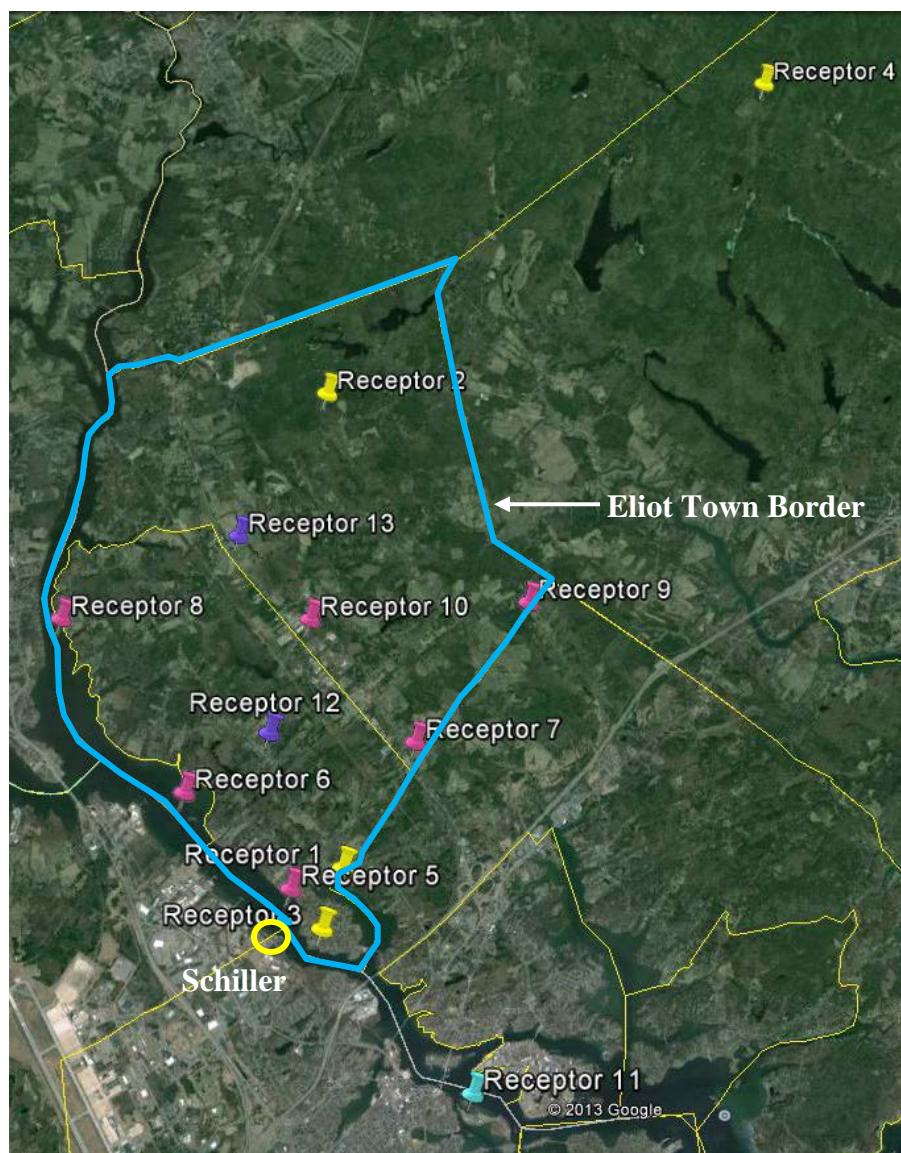
3) **Receptor 3** is the area of the 4th high max daily 1-hour concentration in Eliot averaged over the modeled met period (i.e. the model result in the form of the standard, about 600m E of Schiller).

4) **Receptor 4** represents the area of maximum impact in Maine based on Wingra's modeling (outside of Eliot).

5) An additional 8 **receptors (5-10, 12-13)** were added to the modeling analysis in order to represent all of Eliot, especially those where previous modeling indicated higher than average power plant impacts and locations of schools.

6) **Receptor 11** represents the Peirce Island NHDES SO<sub>2</sub> monitoring station.

**Figure 20: Map of Eliot, ME and NHDES Modeled Receptors**



The NHDES modeling scenarios are based on existing data files used in the Eliot section 126 petition and are processed using generally accepted techniques to assess the most realistic hourly SO<sub>2</sub> design values for the town of Eliot, Maine. The goal of this work is to assess what occurred in Eliot during years since the 2010 1-hour SO<sub>2</sub> NAAQS became applicable and thus only actual emissions were modeled. This analysis is not meant to ensure the threshold of the NAAQS will never be exceeded. Further, since ongoing exposure is of concern, annual average SO<sub>2</sub> concentrations were also evaluated.

**Scenario 1 (Hourly Match):** Matching hourly Schiller SO<sub>2</sub> emissions and modeled impacts in Eliot with same hourly measured SO<sub>2</sub> background from a local monitor. Daily maximum 1-hour SO<sub>2</sub> concentrations are tabulated and the 99<sup>th</sup> percentile of daily maximum are calculated for each of three years and then averaged into an estimated design value.

**Scenario 2 (Annual Average):** Matching of hourly Schiller SO<sub>2</sub> emissions and modeled impacts in Eliot with same hour SO<sub>2</sub> background monitoring. Average 1-hour SO<sub>2</sub> concentrations are tabulated for all hours of each of three years and then averaged into a 3-year average value.

**Scenario 3 (Seasonal):** All hourly SO<sub>2</sub> concentrations (modeled and monitored) for the 3-year period are sorted by season. For each season, the 99<sup>th</sup> percentile modeled and monitored SO<sub>2</sub> concentration is calculated for each hour of the day spanning the 3-year period. The 99<sup>th</sup> percentile values for each season are then averaged and then modeled values are added to the background monitored values to form an estimated design value.

This analysis uses monitored background SO<sub>2</sub> collected from NHDES' Peirce Island monitor. Per EPA technical assistance documentation, a 90 degree sector centered on the upwind direction of Schiller Station to the Peirce Island monitor was excluded. Where monitored data were missing, the average of all valid data over the three years was substituted, regardless of the direction of the wind.

Modeling of actual emissions plus sectorized background was compared. While the modeling did in many cases over-predict for the Peirce Island monitor (receptor #11), it performed reasonably well identifying higher concentrations. Perhaps applying the corrections identified by PSNH's contractor would improve performance.

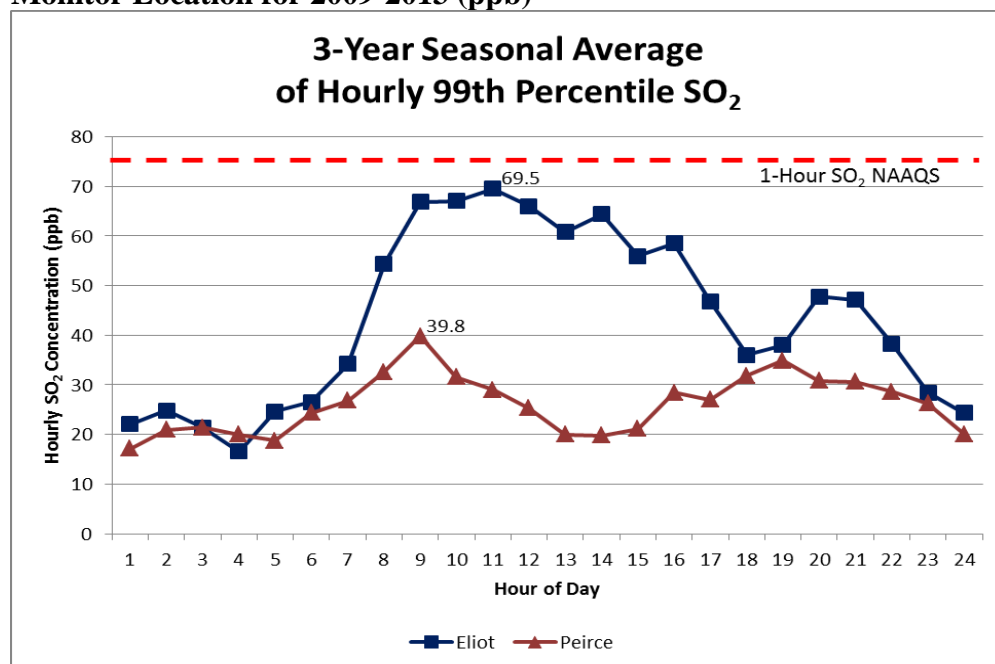
The NHDES modeling analysis finds some peak 1-hour SO<sub>2</sub> concentrations do exceed 75ppb in Eliot, however such events have not been frequent enough to exceed the form of the 2010 1-hour SO<sub>2</sub> NAAQS. While more conservative assumptions could produce higher predicted power plant impacts, it was the goal of this analysis to provide the most realistic scenarios possible with the available data and modeling files.

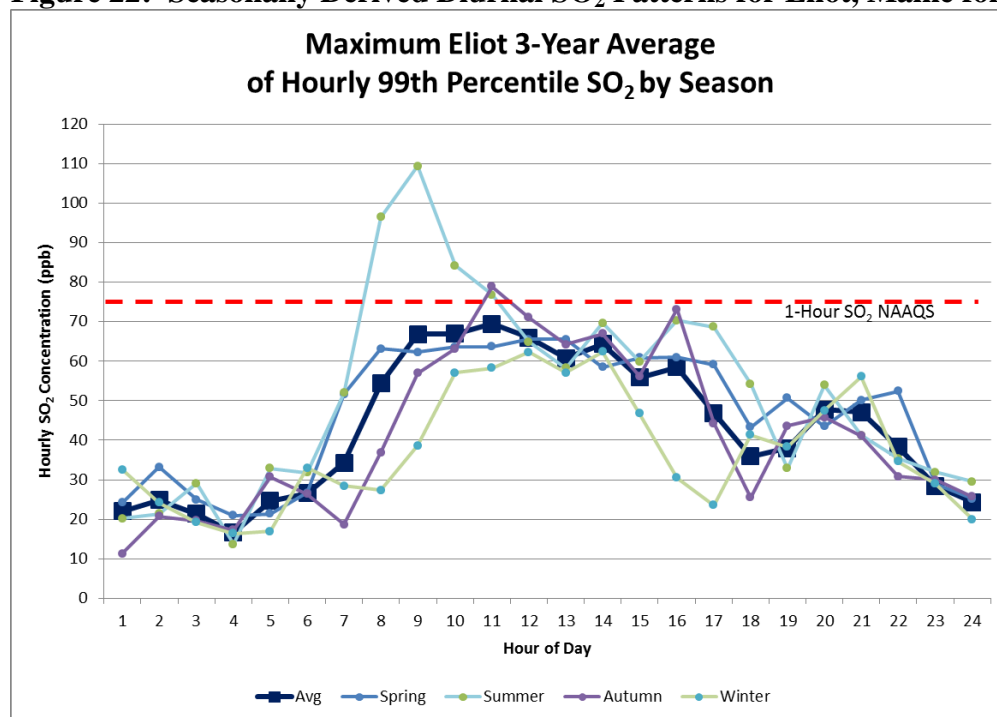
The following modeling results show the maximum value of all modeled receptors located in Eliot for each scenario as indicated. In most cases, maximum model predicted hourly SO<sub>2</sub> concentrations in Eliot were located at receptor #3 (see figure 20). The original NHDES model run (based on Wingra's Run 9) covered the 3-year period from April 1, 2010 to March 31, 2013. However, Schiller operations and emissions were lower than average during 2012. Therefore, NHDES performed a second model run which excluded the 2012 data. For this second run, 2009 CEM data and meteorology were used such that a 3-year period was still maintained after exclusion of the 2012 data. The results of these runs are also shown in Table 7.

**Table 7: Eliot Predicted 1-Hour SO<sub>2</sub> Concentration (ppb)**

Run	Scenario	Eliot, ME (modeled)	Area (monitored)	Eliot Total 1-hour SO <sub>2</sub>
1 (2010-13)	Technique 1 (Hourly Match 99%)	64.5	0.5	64.9
1 (2009-13 excluding 2012)	Technique 1 (Hourly Match 99%)	65.1	0.1	65.2
1 (2010-13)	Technique 1 (Hourly Match Max)	73.5	0.5	73.9
1 (2009-13 excluding 2012)	Technique 1 (Hourly Match Max)	73.5	1.4	74.9
2 (2010-13)	Technique 2 (Annual Average)	1.0	0.9	1.9
2 (2009-13 excluding 2012)	Technique 2 (Annual Average)	1.3	1.4	2.7
3 (2010-13)	Technique 3 (Seasonal 99%)	47.7	14.8	62.5
3 (2009-13 excluding 2012)	Technique 3 (Seasonal 99%)	51.5	18.0	69.5

Seasonal diurnal analyses are summarized in Figures 21 and 22. Figure 21 provides the seasonal 99<sup>th</sup> percentile average values by hour of day for the maximum Eliot modeled receptor and for a receptor (#11) located at the Peirce Island monitor. In both cases, higher predicted hourly SO<sub>2</sub> concentrations occurred during daylight hours (8AM – 6PM). Figure 22 provides information specific to the maximum Eliot modeled receptor broken out by season.

**Figure 21: Seasonally Derived Diurnal SO<sub>2</sub> Patterns for Eliot, Maine and the Peirce Island Monitor Location for 2009-2013 (ppb)**

**Figure 22: Seasonally Derived Diurnal SO<sub>2</sub> Patterns for Eliot, Maine for 2009-2013 (ppb)**

## Summary and Conclusions

On August 22, 2013, the Town of Eliot Maine filed a section 126 petition against PSNH Schiller Station for causing violations of the 2010 1-hour SO<sub>2</sub> NAAQS within its borders. The petition included 1-hour SO<sub>2</sub> modeling analysis that was conducted by Wingra Engineering on behalf of Sierra Club. NHDES and PSNH's modeling contractor have reviewed these modeling files. Since Wingra's report did not tabulate maximum predicted 1-hour SO<sub>2</sub> impacts in Eliot itself, NHDES performed additional modeling using Wingra's unaltered files to more closely examine maximum predicted impacts at locations in Eliot. The NHDES modeling focused on the most recent actual emissions at Schiller Station, which is consistent with the current EPA draft technical assistance documentation for performing attainment demonstration modeling.

An assessment of NHDES model performance with hourly SO<sub>2</sub> monitoring data collected at Peirce Island indicate the model replicated peak values relatively well. This suggests that the results of this modeling are likely to be reasonably accurate in assessing actual conditions in Eliot Maine during years pertinent to the 2010 1-hour SO<sub>2</sub> NAAQS. However, as previously noted, there are a number of technical corrections that should be made to the modeling files before the EPA required attainment assessment is made (or an approvable monitoring alternative is applied).

The results of NHDES modeling suggest that no violations of the 2010 1-hour SO<sub>2</sub> NAAQS occurred at any Eliot receptor location modeled using the most recent actual emissions from Schiller Station (see Table 7 above). A second, more conservative, model run was performed which excluded emissions from 2012 due to lower than average operations and substituted emissions from 2009. These results are shown in Table 7 and do not indicate any violations of the 1-hour SO<sub>2</sub> NAAQS at receptors in Eliot.



Historical and recent SO<sub>2</sub> monitoring data for the Portsmouth region have been presented in this report. During a 30-day period in 1999, SO<sub>2</sub> data monitored in Eliot, ME and at the Portsmouth Vaughn Street monitor showed single-hour measurements over the level of the 2010 1-hour SO<sub>2</sub> NAAQS. However, an analysis of the meteorology associated with these measurements indicates that winds were not coming from the direction of Schiller Station during the hours that the high values were measured. Recent SO<sub>2</sub> monitoring data from the NHDES Peirce Island monitor show that 1-hour SO<sub>2</sub> design values have been well below the 1-hour SO<sub>2</sub> NAAQS since it was implemented in 2010 (please see Figure 2).

Schiller Station unit #5 was converted from coal to biomass in 2006, and emissions and emission rates for the facility show a clear downward trend as evidenced in Figures 15 through 17. Official quality-assured monitoring data at the NHDES Peirce Island monitor do not indicate that the area should be classified as nonattainment for the 2010 1-hour SO<sub>2</sub> NAAQS. The preliminary modeling discussed in this report similarly does not suggest that 1-hour SO<sub>2</sub> design values Eliot, ME would exceed the NAAQS based on recent emissions and operations at Schiller Station. However, official attainment designation modeling for the area cannot be performed until EPA issues final binding guidance for performing such analyses.

In summary, this analysis is not intended to be a thorough attainment assessment for the Portsmouth region. The goal is to better understand recent actual SO<sub>2</sub> conditions specific to Eliot Maine. An official modeling assessment for Schiller Station may be required under EPA SO<sub>2</sub> implementation rule and will likely include a number of modeling improvements that were identified during the process. Further, modeling recent emission and weather conditions is not a guarantee of future operations, weather patterns, or attainment status.

## **ATTACHMENT A**

## **ATTACHMENT B**